CLAIMS

What is claimed is:

1. A method for detecting radiation damage in an area of brain tissues, wherein the area of brain tissues has at least a first region containing brain tissues damaged from radiation exposure and a second region containing no brain tissues damaged from radiation exposure, comprising the steps of:

   illuminating in vivo the area of brain tissues with a coherent light at an incident wavelength, λ_0, between 330 nm and 360 nm;

   collecting electromagnetic emission returned from the illuminated brain tissues;

   identifying a first peak of intensity of the collected electromagnetic emission at a first wavelength, λ_1, and a second peak of intensity of the collected electromagnetic emission at a second wavelength, λ_2, wherein λ_0, λ_1, and λ_2 satisfy the following relationship of $\lambda_1 > \lambda_2 > \lambda_0$; and

   locating the first region containing brain tissues damaged from radiation exposure as the region of brain tissues where the first peak of intensity of the collected electromagnetic emission is corresponding to.

2. The method of claim 1, wherein the first region further comprises tumor.

3. The method of claim 1, wherein the second region comprises normal brain tissues.

4. The method of claim 3, wherein the second region further comprises tumor.

5. The method of claim 1, wherein the incident wavelength, $\lambda_{0,}$ of the coherent light is substantially at around 337 nm.

6. The method of claim 1, wherein the coherent light is emitted from a laser light source.

7. The method of claim 1, wherein the first wavelength, $\lambda_{1,}$ of the collected electromagnetic emission is substantially at around 500 nm.

8. The method of claim 7, wherein the second wavelength, $\lambda_{2,}$ of the collected electromagnetic emission is substantially at around 460 nm.

9. An apparatus for detecting radiation damage in an area of brain tissues, wherein the area of brain tissues has at least a first region containing brain tissues damaged from radiation exposure and a second region containing no brain tissues damaged from radiation exposure, comprising:

means for illuminating in vivo the area of brain tissues with a coherent light at an incident wavelength, $\lambda_{0,}$ between 330 nm and 360 nm;

means for collecting electromagnetic emission returned from the illuminated brain tissues;

means for identifying a first peak of intensity of the collected electromagnetic emission at a first wavelength, λ_1, and a second peak of intensity of the collected electromagnetic emission at a second wavelength, λ_2, wherein λ_0, $\lambda_{1,}$ and λ_2 satisfy the following relationship of $\lambda_1 > \lambda_2 > \lambda_0$; and

means for locating the first region containing brain tissues damaged from

radiation exposure as the region of brain tissues where the first peak of intensity of the collected electromagnetic emission is corresponding to.

10. The apparatus of claim 9, wherein the first region further comprises tumor.

11. The apparatus of claim 9, wherein the second region comprises normal brain tissues.

12. The apparatus of claim 11, wherein the second region further comprises tumor.

13. The apparatus of claim 9, wherein the incident wavelength, λ_0, of the coherent light is substantially at around 337 nm.

14. The apparatus of claim 9, wherein the means for illuminating comprises a laser light source.

15. The apparatus of claim 14, wherein the means for collecting comprises a fiber optical probe coupled with the laser light source so as to deliver in vivo the laser light to an area of brain tissues proximal a working end of the probe.

16. The apparatus of claim 15, wherein the means for collecting further comprises a spectroscope coupled with the fiber optical probe so as to receive from the working end of the probe, fluorescent light emitted from the area in response to illumination by the coherent light.

17. The apparatus of claim 16, wherein the means for identifying comprises a system controller operatively coupled with the spectroscope.

18. The apparatus of claim 9, wherein the first wavelength, $\lambda_{1,}$ of the collected electromagnetic emission is substantially at around 500 nm.

19. The apparatus of claim 15, wherein the second wavelength, $\lambda_{2,}$ of the collected electromagnetic emission is substantially at around 460 nm.

20. An apparatus for detecting radiation damage in an area of brain tissues, wherein the area of brain tissues has at least a first region containing brain tissues damaged from radiation exposure and a second region containing no brain tissues damaged from radiation exposure, comprising:

a laser light source emitting a coherent light with an incident wavelength, $\lambda_{0,}$ between 330 nm and 360 nm;

a fiber optical probe coupled with the laser light source so as to deliver in vivo the laser light to an area of brain tissue proximal a working end of the probe;

a spectroscope coupled with the fiber optical probe so as to receive from the working end of the probe, fluorescent light emitted from the area in response to illumination by the coherent light;

a system controller operatively coupled with the spectroscope and configured to generate a spectrum having a first peak of intensity of the fluorescent light at a first wavelength, λ_1, and a second peak of intensity of the fluorescent light at a second wavelength, λ_2, wherein λ_0, $\lambda_{1,}$ λ_2 satisfy the following relationship of $\lambda_1 > \lambda_2 > \lambda_0$.

21. The apparatus of claim 20, wherein the first region containing brain tissues damaged from radiation exposure is corresponding to the region of brain

tissues where the first peak of intensity of the fluorescent light at the first wavelength λ_1 is emitted.

22. The apparatus of claim 21, wherein the first wavelength, λ_1, is substantially at around 500 nm.

23. A method for detecting radiation damage in an area of tissues associated with a living subject, wherein the area of tissues has at least a first region containing tissues damaged from radiation exposure and a second region containing no tissues damaged from radiation exposure, comprising the steps of:

illuminating the area of tissues with a coherent light at an incident wavelength, $\lambda_{0,}$ between 330 nm and 360 nm;

collecting electromagnetic emission returned from the illuminated tissues;

identifying a first peak of intensity of the collected electromagnetic emission at a first wavelength, λ_1, and a second peak of intensity of the collected electromagnetic emission at a second wavelength, λ_2, wherein λ_0, $\lambda_{1,}$ and λ_2 satisfy the following relationship of $\lambda_1 > \lambda_2 > \lambda_0$; and

locating the first region containing tissues damaged from radiation exposure as the region of tissues where the first peak of intensity of the collected electromagnetic emission is corresponding to.

24. The method of claim 23, wherein the first region further comprises tumor.

25. The method of claim 23, wherein the second region comprises normal tissues.

26. The method of claim 25, wherein the second region further comprises tumor.

27. The method of claim 23, wherein the incident wavelength, $\lambda_{0,}$ of the coherent light is substantially at around 337 nm.

28. The method of claim 23, wherein the coherent light is emitted from a laser light source.

29. The method of claim 23, wherein the first wavelength, $\lambda_{1,}$ of the collected electromagnetic emission is substantially at around 500 nm.

30. The method of claim 29, wherein the second wavelength, $\lambda_{2,}$ of the collected electromagnetic emission is substantially at around 460 nm.

31. The method of claim 23, wherein the living subject is a human being.

32. The method of claim 23, wherein the living subject is an animal.

33. An apparatus for detecting radiation damage in an area of tissues associated with a living subject, wherein the area of tissues has at least a first region containing tissues damaged from radiation exposure and a second region containing no tissues damaged from radiation exposure, comprising the steps of:

means for illuminating the area of tissues with a coherent light at an incident wavelength, $\lambda_{0,}$ between 330 nm and 360 nm;

means for collecting electromagnetic emission returned from the illuminated tissues;

means for identifying a first peak of intensity of the collected electromagnetic emission at a first wavelength, λ_1, and a second peak of intensity of the collected electromagnetic emission at a second wavelength, λ_2, wherein λ_0, λ_1, and λ_2 satisfy the following relationship of $\lambda_1 > \lambda_2 > \lambda_0$; and

means for locating the first region containing tissues damaged from radiation exposure as the region of tissues where the first peak of intensity of the collected electromagnetic emission is corresponding to.

34. The apparatus of claim 33, wherein the first region further comprises tumor.

35. The apparatus of claim 33, wherein the second region comprises normal tissues.

36. The apparatus of claim 35, wherein the second region further comprises tumor.

37. The apparatus of claim 33, wherein the incident wavelength, λ_0, of the coherent light is substantially at around 337 nm.

38. The apparatus of claim 37, wherein the means for illuminating comprises a laser light source.

39. The apparatus of claim 38, wherein the means for collecting comprises a fiber optical probe coupled with the laser light source so as to deliver in vivo the laser light to an area of tissues proximal a working end of the probe.

40. The apparatus of claim 39, wherein the means for collecting further comprises a spectroscope coupled with the fiber optical probe so as to receive from the working end of the probe, fluorescent light emitted from the area in response to illumination by the coherent light.

41. The apparatus of claim 40, wherein the means for identifying comprises a system controller operatively coupled with the spectroscope.

42. The apparatus of claim 33, wherein the first wavelength, λ_1, of the collected electromagnetic emission is substantially at around 500 nm.

43. The apparatus of claim 42, wherein the second wavelength, λ_2, of the collected electromagnetic emission is substantially at around 460 nm.

44. The apparatus of claim 33, wherein the living subject is a human being.

45. The apparatus of claim 33, wherein the living subject is an animal.